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ABSTRACT

The focus of the state of the art paper is on educational product development and evaluation, a relatively new field. After defining the terms curriculum, development, and evaluation, the report classifies the two major forms of curriculum development as system-based (external changes brought into curriculum) and subject-based (internal changes in the content of the curriculum). Three contemporary strategies for curriculum development are: the Tyler strategy (preliminary analysis, selecting and defining objectives, selecting and creating learning experiences, organizing learning experiences, and curriculum evaluation), the DeVault and Anglin strategy, (needs assessment, development and tryout, field verification, and implementation), and the Popham strategy (goal selection, explication of the product's mission, development of the initial product, developmental testing and revision, installation testing, and diffusion). Evaluation in product development involves both summative and formative evaluation, the latter having a major role in the development of curriculum products. Formative evaluation helps form and provide feedback information in a systematic manner and assists the curriculum development process by examining procedures and materials. Implications for further instructional product development emphasize: curriculum development as a practical matter, early dissemination, the unity and continuity of curriculum development, and the necessity of post-publication evaluation. References conclude the report. (JB)

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The Center for Occupational Education at North Carolina State University at Raleigh is a research and development center established in 1965 under the provisions of the Vocational Education Act of 1963. The Center has been established as an integral unit within the School of Education at North Carolina State University, and its major programs are supported by contracts with the National Institute of Education. The Center has as its mission the provision—through research, development, and related activities—of a continuing contribution to the improvement of occupational education. The major research and development programs of the Center focus on the relationship of occupational education to its context or environment. The frame of reference for occupational education includes its relationship to regional economy, politics, and the employment or work environment. In addition to its primary programs, the Center also maintains a Division of Special Service Projects which provides the capability for flexible action within the Center's overall mission. Funding for these projects is not maintained through the Center's federal grant, but rather negotiated on a project-by-project basis with contracting agencies.

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Dr. John K. Coster, Director
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North Carolina State University at Raleigh
P. O. Box 5096
Raleigh, North Carolina 27607

PREFACE

This paper was originally presented to the General Session of the Division of New and Related Services, American Vocational Association, at its annual convention in Atlanta, December, 1973. Dr. Hampson has graciously agreed to make the paper available for publication in the Career and Vocational Education Professional Development report series.

Educational product development and evaluation is a relatively new field. In light of the emphasis placed on training personnel in new curricula and in new emerging curriculum strategies, it is especially timely for personnel development coordinators. The Center is grateful to Dr. Hampson for allowing us to share his ideas with others in career and vocational education.

The Center acknowledges the work of three staff members in the preparation of this report: Mrs. Carolyn Williams, reviewing; Mrs. Sue King, editing; and Betty Randall, typing.

John K. Coster
Director

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Introduction

The field of educational product development and evaluation is rapidly evolving, but it is still in its infancy. While most educational product developers and evaluators would agree on this statement, it is perhaps indicative of the state of the art in the field that this is probably about all they would agree upon. Beyond this statement, the observer would hear a cacophony of alternative stances, each of which represents a defensible (at least on some grounds) position.

This state of the art paper, which is limited to curriculum development and evaluation, outlines (1) two major forms of curriculum development, (2) three examples of development strategies, and (3) two forms of evaluation in product development. In addition, I have raised some points of concern toward which all persons involved in curriculum development should seriously address their attention.

Definitions

Before launching into a paper using the terms curriculum, development and evaluation, I feel it necessary to define those terms--obviously, not to everyone's satisfaction, but at least for the purposes of this paper.

The term curriculum, as James Popham[1] pointed out, "might well serve as the educational counterpart of a typical Rorschach projective stimulus." Almost as many perceptions exist of what a curriculum is as

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[1]W. James Popham, "Validated Instructional Materials as the Focus of an Effective Curriculum Development Strategy" (paper prepared for the National Institute of Education, Career Education Program, October, 1973).

there are persons capable of offering a perception. For the purposes of this paper, curriculum is defined as that planned set of identified educational objectives and learning experiences, organized in a manner to facilitate evaluation of learner outcomes, which constitute an educational program.

The term development used in this paper borrows heavily from the work of John Hemphill[2] and Ralph Tyler[3] and is defined as the systematic process of creating new curricular alternatives that contribute to the improvement of educational practice by the selecting and organizing of educational objectives and experiences in such a manner as to provide for pre-determined learner outcomes.

Finally, the term evaluation in the context of this paper refers to the checking of the concepts and organized educational objectives and experiences against the realities to which they are supposed to refer.[4]

Forms of Curriculum Development

Curriculum development efforts may be classified in a number of ways. A useful distinction, at a general level, has been made by the Organisation of Economic and Cooperative Development (OECD) in its

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[2] John Hemphill, "Educational Development," Educational Development: A New Discipline for Self Renewal (Eugene, Oregon: Center for the Advanced Study of Educational Administration, 1973).

[3] Ralph W. Tyler, "Specific Approaches to Curriculum Development" (paper prepared for the National Institute of Education, Career Education Program, October, 1973).

[4] Ibid.

Handbook on Curriculum Development.[5] The OECD posits two forms of development--system-based and subject-based development.

System-based development refers largely to educational reforms engendered by social and economic forces external to the educational system, but which result in a modification of the system. Development efforts which take the system-based form stem from broad political and social considerations, rather than more narrow education considerations. According to OECD, practically all western nations have undergone system-based reform within the past two decades. The best contemporary example in the United States is career education. While the career education movement has borrowed much of its curriculum development technology from its subject-based predecessors, it represents a major departure in curriculum development in that it cuts across subjects and vocuses upon a vital current problem--namely, the role and relationship of education to the evolution or "playing out" of the remainder of one's life. When viewed in this light, career education represents a change in the educational system, especially with regard to the goals of education.

Other examples of system-based development, according to OECD, include (1) the move toward later selection of and separation into different types of post-primary schooling based on a quest for democratization and resultant pressures to defer differentiation of the curriculum, (2) expansion of the primary curriculum beyond cognitive goals, and (3) the move toward "deschooling" (as a local reflection of changing

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[5] Organisation for Economic Cooperation and Development, Centre for Educational Research and Innovation, Handbook on Curriculum Development (Paris: OECD, 1973).

national t rms and mores) or, on a less radical level, the overall structural reform in the English "progressive" or the Montesorri schools.

Subject-based development refers to internal changes in the content of the curriculum. It is the type of curriculum development that developers are most familiar with, both conceptually and from a "hands on" perspective, and it is the type to which this paper gives major attention. Pressures from the political/social arena are not absent from the subject-based development effort, but development activity is a relatively straightforward task. The rationale is spelled out in terms of modernization of the subject matter, and the developer is able to keep his sites qualitatively on improving the particular segment of the curriculum of interest without having to derive a working framework from the broad pronouncements of the politician, the evangelist, or the prophet.

Subject-based development, while aligned principally with the development of teaching and learning materials, is not a homogeneous set of activities. OECD has subdivided the subject-based approach to curriculum development into three main branches, which are, in turn, based on the three models developed by Havelock--(1) research, development, and diffusion, (2) social interaction, and (3) problem-solving.[6]

The research, development, and diffusion (R, D, & D) model assumes a linear set of activities running through the application of research, prototype design, field testing, revision, mass production, dissemination and, of course, implementation. The developer's role is seen as that of

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[6]Ronald G. Havelock, The Change Agent's Guide to Innovation in Education (Englewood Cliffs, New Jersey: Educational Technology Publications, 1973).

preparing the curriculum package in a central location and then marketing the products to a client body. Costs of curriculum developed in this mode are high. High adoption is the major argument for justification of funding.

One limitation of this approach appears to be individual differences in teacher skills and attitudes which tend to see the materials used in different ways than originally anticipated by the developer. Another is the fact that curricula developed in this manner have often failed to sell as well as expected. Finally, there is an increased questioning of the idea (as any experienced developer will attest) of the linear simplicity of the R, D, & D model.

The second member of the family is the social interaction model in which the emphasis is on dissemination. The thrust is to disseminate curricula developed at one point in the field to a neighboring site. The developer in this approach acts as a communicator rather than a generator of concepts.

The American Association for the Advancement of Science project is an example of this approach. The central team concentrates on building up a network of teachers or "mini-developers" and performs the function of collecting and disseminating ideas generated from this network.

Limitations of this approach appear to be the varying quality of products one can gather from the network (not all mini-developers have the same talents or standards) and the tendency of the network to break down once the central team has been disbanded. It appears that this model can encourage local talent and enthusiasm; however, it can also result in redundancy through duplication and varying quality of products.

The third member of the family is the problem-solving model. The developer in this approach puts great weight on "client need" and attempts to help in the search for "a best available solution" and its adaptation to meet the client's need. Obviously, this approach places greater emphasis on satisfying client need than meeting pre-designed learning objectives. A market orientation prevails.

An interesting limitation of this approach is that it depends heavily on the client's ability to diagnose his own problems. This has ramifications for the continued professional development of teachers and others who would do the diagnosing. Another limitation is that in being so "client-specific," it is difficult to transport results to other sites.

Having reviewed the three subject-based curriculum development models individually, it is necessary to point out, if only for this writer's peace of mind, that they are not mutually exclusive. It is possible to go further and posit that successful curriculum development in this arena will probably rest upon a balanced application of all three models. In the three models are the ingredients of a successful development effort--namely, (1) problem identification of user needs through the problem-solving approach, (2) finding solutions through the R, D, & D approach, and (3) promotion of widespread usage through the social interaction model.

Curriculum Development Strategies

Attention is now directed to an analysis of three contemporary strategies of curriculum development. Strategy refers to that set of techniques (steps and activities) that together enable the development

of a curriculum. At this level of analysis, the possible combinations of approaches multiply rapidly. I will not attempt to cover them all, but I will attempt to give some illustrations and three examples of curriculum development strategies which point out major differences currently existing in the field. The first is that offered by Ralph W. Tyler[7] which provides a set of techniques which might be termed "generic" in that they are not subject matter-specific; the second strategy is that used by M. Vane DeVault and Leo Anglin[8] in the development of their SRA Mathematics Learning System and is of particular interest in that (1) inclusion of their strategy represents attention to a commercial publisher's major development effort; (2) it illustrates an increasing move toward a recognition on the part of the publishing world of the role of field testing; and (3) the strategy examined will be that recommended by W. James Popham.[9] This strategy is used to develop validated instructional materials aimed at reducing the role of the teacher in delivery of the curriculum to the student. (These are popularly and mistakenly referred to as "teacher-proof" materials.)

The Tyler strategy is not subject matter-specific and has served many curriculum developers well from any subject matter starting point. It offers five techniques for undertaking curriculum development:

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[7] Tyler, op. cit.

[8] M. Vane DeVault and Leo Anglin, "Strategy for Curriculum Development: SRA Mathematics Learning System" (paper prepared for the National Institute of Education, Career Education Program, October, 1973).

[9] Popham, op. cit.

preliminary analysis, selecting and defining objectives, selecting and defining learning experiences, organizing learning experiences, and curriculum evaluation.

Preliminary analysis is the systematic analysis of the needs or problems that have stimulated interest in a given development in order that the development effort will adequately solve the problem.

Selecting and defining objectives is a combination of "artistic design, critical analysis, human judgments and empirical testing."[10] Not only is this a complex task, but it is a continuing one, being in progress while other tasks are being carried on and, indeed, after the curriculum is in the classroom as the bases for new judgments about objectives emerge.

Selecting and creating learning experiences is even more of a creative venture than selecting objectives. The developer gets some help from the learning objective, mainly in appraising learning experiences, not creating them. In this task it is vital that the developer use the perspective of the student for whom they are created. Experiences should be achievable, thereby stimulating further confidence, and worthwile in order to stimulate further involvement.

Organizing learning experiences attempts to frame those experiences in such a manner as to offer sequence, so that each experience builds upon earlier experiences, and integration of connections, perceived by the learner between the experiences he/she undergoes.

Curriculum evaluation is the process of checking the validity of the conceptions the developer has about persons, processes, and objects involved in the curriculum.

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[10] Tyler, op. cit.

The DeVault and Anglin strategy for developing the SRA Mathematics Learning System had four basic elements: a needs assessment, initial development-tryout-feedback-redevelopment, field verification, and implementation.

The needs assessment used in this project attempts to determine from the field whether the demand for new curricula is one of "building better" existing materials or developing a new set of products. The assessment also examines such factors as school organization, building design, community requirements, and the need to avoid racism and sexism in product development. From the needs assessment emerges the setting of goals, the determining of personnel resources, the writing of curriculum objectives, and the setting up of a management system to undertake the development task.

The elements of development and tryout are intertwined as used by DeVault and Anglin. As initial development and review take place, "tryout" sites are identified and a field observer chosen by the site to coordinate and assess the program. Written reactions from teachers, staff development sessions, and observations by the liaison member constitute feedback to the developer. Assumptions originally framed by the developer are either confirmed or revised. Revisions in the material are undertaken.

Field verification, while making use of pre- and post-achievement data as a sensor of success of the materials, relies heavily on a whole set of teacher and pupil reactions which might be considered less formal. Sales staff reactions and suggestions based upon their

interaction with teachers are considered an important input to the verification activity. At the end of this activity, the materials are considered ready for regular classroom use.

Implementation begins early in this strategy. It is considered begun when sales staff become involved, and in this strategy they are involved from the needs assessment onward. As the project gets underway, publicity is generated alongside the development effort. Newsletters, meetings, advertizing, and invitations to teachers and administrators to visit field verification schools are encouraged.

Popham's strategy is aimed at the creation of validated instructional materials. Validation data are accumulated prior to the distribution of the materials to indicate that they work. The three phases of the Popham strategy are: specifying the intended outcomes in measurable terms, developing a replicable instructional sequence aimed at accomplishing those outcomes, and, on the basis of measured post-instruction performance of learners, revising until the intended results are achieved. The following steps make up the strategy:

1. Goal selection, in which the developer attempts to decide what the instructional materials are intended to accomplish. As part of this activity, a market survey would be conducted to verify the need for the intended product. Another facet of this step should be to gain a sense of the ultimate cost of the product.

2. Explication of the product's mission, in which the product's mission is translated into specifics. At this step criterion-referenced measures would be developed to test the product's ability to impact as it claims. Such specifics as the level of learner behavior sought would be defined.

3. Development of the initial product. Popham suggests that this be achieved in small bites, trying it out on learners and then modifying it as appropriate.

4. Developmental testing and revision. At this point the product is subjected to a series of field trials in which the "post-instruction" performance of learners on the devised criterion test serves as the index of the degree to which the materials need to be revised. The revision cycle is reiterated until the level of desired learner propriety is attained.

5. Installation testing, which involves careful consideration of the best way to disseminate the finished products. In some cases increased field test size begins to develop a market. The developer should aim to try out a range of possible approaches to placing the materials satisfactorily in the field.

6. Diffusion, which is based upon any market generated and usually undertaken by a publishing house.

This examination of three strategies employed by curriculum developers to frame their efforts has revealed little agreement on the details of development. The answers to such questions as how one specifies curriculum objectives, undertakes the technology of development, collects revisionary data in what form, field-tests, and revises are not agreed upon. However, some general principles do begin to emerge even if their final definition is open to interpretation. The first is the necessity of questioning need--what is wanted for what purposes by what type of client group. Second is the need for the development of curricular objectives at any level of specificity. The third is the need for a set

of activities which should aim to provide a means of meeting curricular objectives and upon which feedback should be gathered from the user to be used in revision of the products. The fourth is the importance of considering methods for implementation and dissemination during the development effort itself.

Evaluation in Product Development

Thus, far, this paper has outlined two major forms and three major contemporary strategies of curriculum development. Attention is now directed to product evaluation. Again, two major forms may be identified--summative and formative evaluation.[11]

Summative Evaluation

Summative evaluation, according to current definitions, attempts to assess how the final product, i.e., curriculum, works when it is implemented on a wide scale in the field. However, given the changing nature of curriculum products, the regular revision by publishers, and their adaptation/adoption by teachers, the usefulness and practicality of summative evaluation for assessing the curriculum product are open to question. Almost without exception, curriculum materials do not stand still long enough, in either form or mode of delivery, to be summatively evaluated. In addition, even when a summative evaluation has been attempted, claims of artificiality of the testing environment, inadequacy of measures, poor analysis based upon poor data, and the questionable position of attempting to quantify quality of performance leave much to be desired. Finally, there is a serious questioning of what is learned

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[11]Ralph W. Tyler, Robert M. Gagne, and Michael Scriven, Perspectives on Curriculum Evaluation (Chicago: Rand-McNally, 1969).

from such an evaluation. Walker and Schaffarzick,[12] in an analysis of experiments done since 1959 designed to compare subject matter achievement of students using new or innovative curricula with that of students using traditional curricula, found

> that each curriculum was superior in its own terms. More precisely, . . . studies showed that students using different curricula in the same subject generally exhibited different patterns of test performance, and that differences in test performance generally reflected differences in content inclusion and emphasis in curricula.

Therefore, the topic of summative evaluation will not be extensively discussed in this paper for two reasons. The first is the questioning of the role of summative evaluation in a development effort. The second is the serious questioning of the role of summative evaluation, at this stage of its methodological accuracy, in accounting for the impact of the ever-moving, ever-changing nature of curriculum upon students.

Formative Evaluation

Formative evaluation, as opposed to summative evaluation, has a major role to play in the development of curriculum products. By the very nature of its title, this type of evaluation intends to help form, help shape, and provide feedback information in a systematic manner to the development effort of product outcomes. Given the nature of curriculum and curriculum materials, formative evaluation does not cease with the production of a marketable product but, as in the case of the

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[12]Decker F. Walker and J. Schaffarzick, Comparing Different Curricula: A Review of Research and Some Speculation on Its Implications (Stanford, California: Stanford University, 1972).

previously described SRA mathematics program, continues after first publication and can be used to revise the series.

As Baker[13] pointed out, the role of formative evaluation in educational product development is simply "to gather information that will assist program improvement." The guiding principle in this task should be austerity, referring in this context to "a structural austerity being imposed at the outset of a development process, particularly in terms of gathering and using information (and only that information) which will aid in decisions to proceed to the next level of development."[14]

Having concluded that a strict definition of summative evaluation precludes its usefulness in product development and that a massive role in product development exists for formative evaluation, it is possible to go even further and suggest that a major part of any development activity has to do with formative evaluation. Formative evaluation should assist the development process at every step of the way by examining procedures and materials developed. The guiding question should be how one might examine every element of the program in order to improve its outcome. In order to answer this question, formative evaluation must be built into the development effort from the outset. I would argue that not only should the formative evaluator be involved, but that he should participate in the initial specification of procedures and development tools. Built in from the beginning, the role of the formative evaluator has the

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[13]Eva L. Baker, "Formative Evaluation and Instructional Development" (paper prepared at the University of California at Los Angeles, 1973).

[14]David H. Hampson, "Curriculum Development Policy Position" (paper developed as part of the NIE School-Based Career Education Program planning, 1973).

responsibility for examining and making the development process more efficient and effective.

The major elements of the development process to be considered by the formative evaluator are goals, plans, operations, and result assessment; obviously, relationships exist among these four elements, and the formative evaluator should be sensitive to any changes undertaken in one element that might have impact on another element.

As can be noted from the discussion of development strategies, the need to specify goals and objectives clearly is paramount to the development effort. The question posed here by the formative evaluator is simply--what do we intend to achieve? The task of the formative evaluator is to clarify the goals and objectives presented by the developer. As Hulda Grobman[15] stated, the task is to help the developer describe his or her real objectives. Hopefully, the formative evaluator will be able to work with the developer from the question, "As you have stated this outcome, is it really a goal?" through a statement of real goals, to the question of reasonable attainability.

Planning a development effort is a complex business. The formative evaluator should aim to work with the developer in ascertaining the reasonableness of the plans, their apparent ability to achieve what they intend, and, of course, their understandability to persons who will have to follow them.

The guiding question with regard to operations is--are we operating as we had planned? The formative evaluator performs the role of

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[15]Hulda Grobman, Evaluation Activities of Curriculum Projects: A Starting Point (Chicago: Rand-McNally, 1968).

the mechanic running alongisde the car and trying to improve the timing. In order to accomplish this task satisfactorily, the formative evaluator must be capable of creating a picture in his mind of what the operationalization of the plans should look like. If the outcomes are different than originally pictured, e.g., teachers reject a new product during pilot-testing, it is vital that the formative evaluator gain information on why this occurred.

The result assessment element of the formative evaluation activity provides the feedback for product modification. From this element the development effort will gain insights and data on the achievement of its goals and objectives. Instruments have to be chosen or developed to accomplish that verification activity. The formative evaluator must make a choice among achievement tests, questionnaires, records to be kept, observations, and interviews to be conducted. In order to choose the necessary instrumentation, the formative evaluator must decide which goals are to be measured for attainment, whether the method of measuring is reliable, and, of course, what the findings mean for product revision.

In summary, therefore, we have noted that formative evaluation is an integral part of the product development process. It should be a part of the development activity from the outset, providing a flow of feedback across the elements of goal specification, planning, operations, and result assessment. Finally, the point should be made that not only will the use of formative evaluation aid the quality of products under development, but, if expeditiously used, it will prevent a waste of development funds.

Implications for Curriculum Developers

The following points highlight a series of implications for further and improved instructional product development.

Curriculum development is a practical matter. There should be greater realization on the part of the development community that curriculum development has not only to develop products which result in better practice, but also to tie in closely with the classroom environment for both the gathering and selection of data and the trying out of ideas.

Think dissemination early. Developers have been traditionally naive about the ultimate dissemination of their products, and the development community must come to grips with the problem of dissemination as a problem of development. The agents of dissemination, be they publishers or other groups, and the mode of dissemination should be primary concerns to be addressed early in the development process.

Fragmentation of curriculum. The field of curriculum development has still not adequately addressed itself to the compartmentalism which riddles our educational institutions. The earlier discussed system-based approach to development might be the answer, but the answer will probably lie in structural changes in our institutions.

Continuity of curriculum. Discontinuities between elementary and secondary schools, between different types of institutions at the same level, or between different geographical regions are a major issue to be confronted by the curriculum developer. Again, it looks as if the answers may be found in structural changes. One possibility is the establishment of teacher centers to introduce new curriculum products and information to teachers in a systematic manner and to provide a meeting ground for teachers who would otherwise remain worlds apart.

Post-publication evaluation. In the last few years we have placed a great deal of emphasis upon pre-publication evaluation and almost none on post-publication evaluation. Now, thanks largely to the endeavors of people like those with the educational products information exchange, the issue is beginning to be pursued diligently. California has passed Bill AB 531, Section 9426, which brings to the forefront the concept of "learner verification" after publisher release. Developers are going to have to build serious post-publication evaluation into the planning efforts in the future.

I hope the perspectives I have offered will at least stimulate discussion. The field of educational product development and evaluation is still young. It is, however, by discussion, interchange, and trial that it will grow to maturity.

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